

CLAIMS

1. A reference position correcting device for a conveying mechanism including: a moving member disposed in a conveying vessel, the moving member being capable of moving in a horizontal moving direction; a rotary table attached to the moving member, the rotary table being capable of turning in a horizontal turning direction and moving in a vertical direction; two arm mechanisms attached to the rotary table through vertical rotary shafts spaced apart from each other, the arm mechanisms being capable of bending and stretching in a horizontal operating direction; and picks attached on distal ends of the respective arm mechanisms, each for holding an object to be conveyed; said correcting device comprising:

a light emitter fixedly positioned on the conveying vessel, for emitting a sensing light beam in a horizontal direction crossing the moving direction of the moving member;

a light detector fixedly positioned on the conveying vessel to receive the sensing light beam, for detecting a light-transmitting state and a light-shielding state of the sensing light beam;

a light-shielding member attached on the rotary table, for switching the sensing light beam between the light-transmitting state and the light-shielding state in compliance with a movement and a turn of the rotary table; and

correcting means for correcting reference positions of the rotary table in the moving, vertical, and turning directions, and for correcting a reference position of the arm mechanism in the operating direction, based on a detection by the light detector about the light-transmitting state and the light-shielding state of the sensing light beam switched in compliance with the movement and the turn of the rotary table.

2. The reference position correcting device according to claim 1, wherein

the correction means corrects:

the reference position of the rotary table in the moving direction, based on a position where a horizontal end of the rotary table switches the sensing light beam between the light-transmitting state and the light-shielding state;

the reference position of the rotary table in the vertical direction, based on a position where an upper end of the rotary table or the light-shielding member switches the sensing light beam between the light-transmitting state and the light-shielding state;

the reference position of the rotary table in the turning direction, based on a position where the light-shielding member switches the sensing light beam between the light-transmitting state and the light-shielding state; and

the reference position of the arm mechanism in the operating direction, based on a position where a part of the pick or a part of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state.

3. The reference position correcting device according to claim 1 or 2, wherein

the light-shielding member is formed of a light-shielding plate projecting upward from an upper surface of the rotary table.

4. The reference position correcting device according to claim 3, wherein

the light-shielding member includes a first light-shielding plate disposed on a rotary center of the rotary table, and a second light-shielding plate disposed at a peripheral portion of the rotary table; and

each of the light-shielding plates has a light-transmitting hole formed in a center thereof.

5. The reference position correcting device according to claim 1 or 2, wherein

an attachment part of the pick to the arm mechanism has a larger thickness in the vertical direction than those of other parts of the pick; and

when the reference position of the arm mechanism is corrected in the operating direction, the attachment part of the pick switches the sensing light beam between the light-transmitting state and the light-shielding state.

6. The reference position correcting device according to claim 1 or 2, wherein

the distal end of the arm mechanism on which the pick is attached is formed into an arc shape in plan view; and

when the reference position of the arm mechanism is corrected in the operating direction, the distal end of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state.

7. A reference position correcting device for a conveying mechanism including: a moving member disposed in a conveying vessel, the moving member being capable of moving in a horizontal moving direction; a table attached to the moving member, the table being capable of moving in a vertical direction; an arm mechanism attached to the table, the arm mechanism being capable of turning in a horizontal turning direction and bending and stretching in a horizontal operating direction; and a pick attached on a distal end of the arm mechanism, for holding an object to be conveyed; said correcting device comprising:

a light emitter fixedly positioned on the conveying vessel, for emitting a sensing light beam in a horizontal direction crossing the moving direction of the moving member;

a light detector fixedly positioned on the conveying vessel to receive the sensing light beam, for detecting a light-transmitting state and a light-shielding state of the sensing light beam; and

correcting means for correcting reference positions of the

table in the moving and vertical directions, and for correcting reference positions of the arm mechanism in the turning and the operating direction.

8. The reference position correcting device according to claim 7, wherein

the correcting means corrects:

the reference position of the table in the moving direction, based on a position where a horizontal end of the table switches the sensing light beam between the light-transmitting state and the light-shielding state;

the reference position of the table in the vertical direction, based on a position where a part of the arm mechanism, a part of the pick, or an upper end of the table switches the sensing light beam between the light-transmitting state and the light-shielding state;

the reference position of the arm mechanism in the turning direction, based on a position where a part of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state; and

the reference position of the arm mechanism in the operating direction, based on a position where a part of the pick or a part of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state.

9. The reference position correcting device according to claim 7 or 8, wherein

an attachment part of the pick to the arm mechanism has a larger thickness in the vertical direction than those of other parts of the pick; and

when the reference position of the arm mechanism is corrected in the operating direction, the attachment part of the pick switches the sensing light beam between the light-transmitting state and the light-shielding state.

10. The reference position correcting device according to claim 7 or 8, wherein

the distal end of the arm mechanism on which the pick is attached is formed into an arc shape in plan view; and

when the reference position of the arm mechanism is corrected in the operating direction, the distal end of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state.

11. The reference position correcting device according to claim 7 or 8, wherein

the arm mechanism includes: a first arm attached on the table, the first arm being capable of turning in the horizontal turning direction; and two second arms connected to a distal end of the first arm such that the second arms can rotate in the horizontal plane independently from each other, each of the second arms having the pick attached on a distal end thereof; and

when the reference position of the arm mechanism is corrected in the turning direction, a part of the second arm switches the sensing light beam between the light-transmitting state and the light-shielding state.

12. The reference position correcting device according to claim 11, wherein

an attachment part of each of the picks to the second arms has a larger thickness in the vertical direction than those of other parts of the pick; and

when the reference position of the arm mechanism is corrected in the operating direction, the attachment part of each of the picks switches the sensing light beam between the light-transmitting state and the light-shielding state.

13. The reference position correcting device according to claim 11, wherein

the distal end of each of the second arms on which the

pick is attached is formed into an arc shape in plan view; and

when the reference position of the arm mechanism is corrected in the operating direction, the distal end of each of the second arms switches the sensing light beam between the light-transmitting state and the light-shielding state.

14. A method of correcting reference positions of a conveying mechanism including: a moving member disposed in a conveying vessel, the moving member being capable of moving in a horizontal moving direction; a rotary table attached to the moving member, the rotary table being capable of turning in a horizontal turning direction and moving in a vertical direction; two arm mechanisms attached to the rotary table through vertical rotary shafts spaced apart from each other, the arm mechanisms being capable of bending and stretching in a horizontal operating direction; and picks attached on distal ends of the respective arm mechanisms, each for holding an object to be conveyed; said method comprising the steps of:

emitting a sensing light beam from a light emitter to a light detector each being fixedly positioned on the conveying vessel, in a horizontal direction crossing the moving direction of the moving member;

correcting the reference position of the rotary table in the moving direction, based on a position where a horizontal end of the rotary table switches the sensing light beam between a light-transmitting state and a light-shielding state;

correcting the reference position of the rotary table in the vertical direction, based on a position where an upper end of the rotary table or a light-shielding member attached on the rotary table switches the sensing light beam between the light-transmitting state and the light-shielding state;

correcting the reference position of the rotary table in the turning direction, based on a position where the light-shielding member switches the sensing light beam between the light-transmitting state and the light-shielding state; and

correcting the reference position of the arm mechanism

in the operating direction, based on a position where a part of the pick or a part of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state.

15. A method of correcting reference positions of a conveying mechanism including: a moving member disposed in a conveying vessel, the moving member being capable of moving in a horizontal moving direction; a table attached to the moving member, the table being capable of moving in a vertical direction; an arm mechanism attached to the table, the arm mechanism being capable of turning in a horizontal turning direction and bending and stretching in a horizontal operating direction; and a pick attached on a distal end of the arm mechanism, for holding an object to be conveyed; said method comprising the steps of:

emitting a sensing light beam from a light emitter to a light detector each being fixedly positioned on the conveying vessel, in a horizontal direction crossing the moving direction of the moving member;

correcting the reference position of the table in the moving direction, based on a position where a horizontal end of the table switches the sensing light beam between a light-transmitting state and a light-shielding state;

correcting the reference position of the table in the vertical direction, based on a position where a part of the arm mechanism, a part of the pick, or an upper end of the table switches the sensing light beam between the light-transmitting state and the light-shielding state;

correcting the reference position of the arm mechanism in the turning direction, based on a position where a part of the arm mechanism switches the sensing light beam between the light-transmitting state and the light-shielding state; and

correcting the reference position of the ram mechanism in the operating direction, based on a position where a part of the pick or a part of the arm mechanism switches the sensing

light beam between the light-transmitting state and the light-shielding state.